



Response to Requested Information

craig w. holmes to: Stacey Dwyer
Cc: William Honker, Philip Dellinger, Sam Coleman

09/28/2012 02:31 PM

From: "craig w. holmes" <pommelhouse@sbcglobal.net>
To: Stacey Dwyer/R6/USEPA/US@EPA
Cc: William Honker/R6/USEPA/US@EPA, Philip Dellinger/R6/USEPA/US@EPA, Sam Coleman/R6/USEPA/US@EPA

Stacey,

Attached are five documents providing responses to the information that Region 6 requested during our telephone conference call on September 25, 2012. We would like to have a telephone conference call with you on Monday after you have had time to review the response. We think a call will help everyone get a good grasp on the information. Have a good weekend.



craig w. holmes Overview.docx Responses.doc Response A and B Table 1.xls



Response to A and B Items Table 2.xlsx Response to Item D Table 1.xlsx

00654.pdf

General Overview of Technical Analysis Conclusion

Conclusion

Extensive confining clay layers and direction of localized groundwater flow preclude water from inside the Aquifer Exemption (AE) Boundary from reaching the Braquet Well and the Church Wells (Numbers 26 and 27). Following is a summary explaining this conclusion. In-depth technical details leading to this conclusion are provided the accompanying documents titled:

Responses (A through E)

Responses to Items A and B Table 1

Responses to Items A and B Table 2

Response to Item D Table

Water Level Contour Maps

I. Vertical Confinement

As shown in the various cross-sections that UEC provided Region 6, and which were part of the Mine Permit Application, extensive confining clay layers (aquitards) are present throughout and beyond the AE area. The aquitards restrict vertical migration of groundwater within and beyond the AE area. In particular, three of the previously submitted cross-sections (C-C', A"-Up-17-3, and A-A') verify the continuation of discrete sands that are capped above and below by thick clays beyond the AE area.

In addition to the cross-sections that were submitted Dr. William Galloway, a renowned Texas geologist and leading expert on the geology of the South Texas Uranium Province, stated during the contested case hearing:

“The portion of the Goliad Formation located in Goliad County was deposited by a large, ancient river known as the Cuero River.... Because the Cuero River was meandering, it formed broad, tabular deposits that are typically thirty to sixty feet thick, thousands of feet to tens of thousands of feet wide and tens of miles long.”

He further stated:

“The clay layers are widespread sheets that extend across and beyond the Mine Permit Area. This would be expected in fluvial deposits where flood plains cover much larger areas than do channel fills.”

A copy of Dr. Galloway's Direct Testimony was previously submitted.

II. Groundwater Flow

As can be seen in the attached B sand water level contour maps, groundwater flow in the localized area is from west to east. These maps are computer generated (using the Kriging method for gridding) from the water level surveys conducted in September 2008, March 2010, February 2012 and September 2012. These contours represent lines of equal water level elevation. The maps show that groundwater flows west to east (perpendicular to the contour lines) moving in the direction of decreasing water level elevation.

Groundwater flow in the graben (between the two faults) is about 15.3 feet per year and the direction of flow is from west to east. Because the new Braquet well and Church wells are south of the AE Boundary and because they draw water from the west these wells cannot capture water from the AE area which is to the north. Even if one were to dismiss the fact that the graben causes water to flow from west to east, the time required for the capture zones of the Braquet and Church wells, which are known to be in Sand A, to reach the revised Sand A AE Boundary would be approximately 204 years and 255 years, respectively.

The reason why the localized (between the two faults) groundwater flow rate is only approximately 15.3 feet per year is attributed to the much reduced gradient in the graben. The Northwest Fault acts as a barrier to the regional groundwater flow, thus reducing the gradient inside the graben.



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Response to A and B Items Table 2.xlsx Response to Item D Table 1.xlsx

Response to Information Request: September 26, 2012

Request Items A and B: What is the date for these water level measurements? On Monday, September 24, 2012, Craig Holmes sent Stacey Dwyer a “sand B Summary Table” with water level data from 2008, 2010, and 2012. However, this data does not appear to match up for any of the years on the table. If this data is from another month of a year, please correct your table and add this data with the correct month and year. Please refer to Item B below for the Summary Table.

Reply to Items A and B

The table that was hand delivered to William Honker by Craig Holmes at the EPA/UEC/TCEQ meeting in Austin on September 7, 2012 contains water level data for September 2008. The table is being provided again with this response and is titled “Response to Items A and B Table 1”. As explained in the following paragraphs, water level elevation differences between this table and the “Sand B Summary Table” (sent from Craig Holmes to Stacey Dwyer on 9-24-2012 (Item B)) are the result of using ground surface elevations from a more recent elevation survey and casing height measurements obtained on 9-19-2012.

A comparison of depth to water (“Water Levels, ft” column) in “Response to Items A and B Table 1” to September-08 depth to water (“Water Levels, TOC (ft)” column) in the “Sand B Summary Table” shows that depth to water is identical for the two tables. There are differences in water level elevations between the two tables because surface elevations and casing (CHAGS) heights changed as a result of more recent measurements.

Surface elevations were measured in 2008 and again in 2010. Five wells (BMW-7, BMW-8, BMW-9, PTW-1 and PTW-10) were re-surveyed on 9-19-2012 to verify the 2010 measurements, with a maximum difference of about four inches verifying the 2010 measurements. Surface elevations from 2008 were used for calculating water level elevations in the “Response to A and B Items Table 1” table since it was developed in 2008, prior to the 2010 survey. The “Sand B Summary Table” sent from Craig Holmes to Stacey Dwyer on 9-24-2012 (Item B) used the 2010 surface elevations. A significant survey error of approximately four feet at well BMW-7 was corrected in the 2010 survey.

Minor variances are common in GPS surveys. The GPS survey method used can be affected by several factors including number of satellites acquired, atmospheric disturbances, interference from terrestrial features (buildings, thickets, etc.), resulting in slightly different readings at different times. Ground settlement or heave in the disturbed area around a well casing could also contribute to a slight change in ground surface elevations over time.

Other than at well BMW-7, the maximum surface elevation change between the 2008 measurements and the 2010 measurements was only 7.1 inches. These minor variations in surface elevations between the two surveys provide verification of the accuracy of the measurements.

The casing height (CHAGS), which is the distance from ground surface to the top of casing, was measured in 2008, 2010 (some wells) and most recently on 9-19-2012. The 2008 table ("Response to Items A and B Table 1") used 2008 measurements for CHAGS since the new measurements were not available when it was created. The "Sand B Summary Table" used 2012 measurements for CHAGS. Well BMW-9 had a 2008 CHAGS value of 15.96 inches and a 2012 measurement of 28 inches, resulting in a difference of about one foot. It is likely that the 2008 measurement was 25.96 inches, but was entered incorrectly in the field data sheet. In other words, the casing was not physically altered. Other than for well BMW-9, the maximum CHAGS change between the 2008 measurements and the 2012 measurements was about 7.5 inches. As noted above, ground settlement or heave in the disturbed area around a well could change ground surface elevations slightly over time, thus changing the CHAGS values. The table, "Response to Items A and B Table 2", includes the 2008 and 2012 CHAGS values.

"Response to Items A and B Table 2" lists the water level elevations from both tables ("Response to Items A and B Table 1" and "Sand B Summary Table") and demonstrates that the differences are due to revised surface elevations and revised CHAGS heights. Water level differences exceeded 6 inches at only two wells and averaged about two inches (excluding BMW-7). Comparing the fourth column in the table, "Response to Items A and B Table 2", ("Water Level Elevation Differences") to the twelfth column ("Calculated Change due to Surface Elevation and CHAGS Differences") shows that the values are identical.

Request Item C: Please provide the date for the A-A' south fault cross-sections. I assume the cross-sections were based on data from a previous year (include both the date of the data and a date of generation for this cross-section). Email from Harry Anthony to Stacey Dwyer, et.al on September 14, 2012.

Reply to Item C

The cross-section A-A' was created on September 13, 2012. The logs used to build the section were developed on the following dates:

32201-N183: 8/8/2007

32203-18: 4/27/1984

32203-30: 5/9/1984

32203-39: 5/11/1984

32203-45: 5/14/1984

32203-52: 5/16/1984

Surveys were conducted by the following personnel: Pavan Bairu (2008 survey); Carl Wentz and either Pavan Bairu, Aiguo Bian or James Gale (2010 survey); Carl Wentz (2012 survey); and Carl Wentz, Jon Pollock and Bob Underdown (September 2012 survey).

Request Item D: The contours do not exactly match the data that was submitted to EPA in the Summary Table (see item B above in this email). Please ensure that all the data that is in this graphic for February 2012 is reflected in the Summary Table.

Reply to Item D

The referenced contour plot ("February 2012 B-Sand (graben wells) Water Levels") was developed using water level elevations calculated from 2008 ground surface elevations and 2010 casing height measurements. Water level elevations in the "Sand B Summary Table" (Item B) were calculated using the more recent 2010 ground surface elevations and casing height measurements obtained on 9-19-2012. As discussed in the following paragraphs, these differences and the exclusion of well PTW-14 explain why the contours do not exactly match the water level elevations in the "Sand B Summary Table" (Item B).

The attached table, titled "Response to Item D Table 1", lists the water level elevations from the "Sand B Summary Table" (Item B) and those used to generate the ("February 2012 B-Sand (graben wells) Water Levels") plot and demonstrates that the differences are due to revised surface elevations and revised CHAGS heights. Water level differences exceeded 6 inches at only three wells and averaged about two inches (excluding BMW-7). Comparing the fourth column in the table ("Water Level Elevation Differences") to the twelfth column ("Calculated Change due to Surface Elevation and CHAGS Differences") shows that the values are identical.

Surface elevations were measured in 2008 and again in 2010. Five wells (BMW-7, BMW-8, BMW-9, PTW-1 and PTW-10) were resurveyed on 9-19-2012 to verify the 2010 measurements, with a maximum difference of about four inches verifying the 2010 measurements. Old surface elevations from 2008 were inadvertently used for the "February 2012 B-Sand (graben wells) Water Levels" plot. The "Sand B Summary Table" (Item B) is based on the 2010 surface elevations. Other than for well BMW-7, the maximum surface elevation change between the 2008 measurements and the 2010 measurements was only 7.1 inches. These minor variations in surface elevations between the two surveys provide verification of the accuracy of the measurements.

The CHAGS height, which is the height of the top of casing above ground surface, was re-measured on 9-19-2012. The "February 2012 B-Sand (graben wells) Water Levels" plot used 2010 measurements for CHAGS since the new measurements were not available at that time.

Well BMW-9 had a 2010 CHAGS value of 15.96 inches and a 2012 measurement of 28 inches, resulting in a difference of about one foot. It is likely that the 2010 measurement should have been 25.96 inches, but was entered incorrectly in the field data sheet. Other than for well BMW-9, the maximum CHAGS change between the 2010 measurements and the 2012 measurements was only 5.4 inches.

Well PTW-14 was included in the "Sand B Summary Table" (Item B), but was not used for the "February 2012 B-Sand (graben wells) Water Levels" plot because INTERA was not aware at that time that well CBP-1 had been renamed PTW-14. Well survey information that INTERA had when the "February 2012 B-Sand (graben wells) Water Levels" plot was created included well CBP-1, but did not include an entry under the well name PTW-14. Well PT-BD was included for the "February 2012 B-Sand (graben wells) Water Levels" plot, but not in the "Sand B Summary Table" (Item B) because it is not part of the monitoring well network and was not resurveyed in 2010. PT-BD was installed specifically for the fault pump test.

Request Item E: I have the justification for disregarding BMW-7, but need a justification for all the data that was not considered. Please include the contractor's name that took the water level data measurements.

Reply to Item E

Contour plots for the B Sand water level elevations were developed on 9-21-2012 for water levels collected in September 2008, March 2010, February 2012 and September 2012. Water level elevations used to create each of these plots were included in the Sand B Summary Table (Item B). All of the water levels in the Sand B Summary Table were used for the September 2008, February 2012 and September 2012 contour plots.

As will be discussed below, we excluded wells PTW-1, PTW-9 and PTW-10 from the March 2010 water level contour plot. Well BMW-7 is no longer considered an outlier since the 2010 well elevation resurvey identified a surface elevation error of over four feet for that well. The resurveyed elevation was verified on 9-19-2012. Water levels for well BMW-7 are included in all four contour plots.

We noticed a greater variability in the water level elevation changes from September 2008 to March 2010 than in water level elevation changes from September 2008 to February 2012. This casts doubt on the reliability of the March 2010 water levels as opposed to the 2008 and 2012 measurements. In the March 2010 measuring event, we noted that the water level elevations in PTW-1 and PTW-10 are several feet below those of any other wells sampled at that time. Conversely, the March 2010 water level elevation for well PTW-9 was almost a foot above the water level of any other well sampled at that time.

These results contrasted significantly from both prior and subsequent measuring events. For example, in the September 2008 event, water level elevations in PTW-1, PTW-9 and PTW-10

were 161.89, 161.91 and 161.48 feet, respectively. This compares quite consistently to the February 2012 measurements, which show water levels of 159.49, 159.56 and 159.10 feet. Because the earlier and later measurements are consistent, we believe that the February 2010 water level measurements do not provide an accurate picture of the water levels.



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Response to A and B Items Table 2.xlsx Response to Item D Table 1.xlsx

S.No.	WELL #	Water Levels, ft	Water Levels, ft (MSL)
1	BMW-1	69.9	160.82
2	BMW-2	70.35	160.81
3	BMW-3	70.37	161.074
4	BMW-4	74.91	161.34
5	BMW-5	76.9	161.47
6	BMW-6	75.4	161.51
7	BMW-7	73	166.663
8	BMW-8	69.1	162.153
9	BMW-9	71.3	160.821
10	BMW-10	65.6	162.2
11	BMW-11	55.3	162.143
12	BMW-12	55.28	161.828
13	BMW-13	63.75	162.008
14	BMW-14	72.75	161.762
15	BMW-15	78.35	161.499
16	BMW-16	71.27	161.411
17	BMW-17	65.9	161.345
18	BMW-18	64.2	160.977
19	BMW-19	67.05	160.78
20	BMW-20	68.45	160.764
21	BMW-21	68.37	160.69
22	BMW-22	69.05	160.696
23	OMW-1	63.8	159.769
24	OMW-2	72.85	159.583
25	OMW-3	69.21	159.642
26	OMW-4	78.7	159.222
27	OMW-5	78.15	159.452
28	OMW-6	76.65	159.078
29	OMW-7	77.85	159.127
30	OMW-8	74	158.938
31	OMW-9	71.4	158.987
32	PTW-1	64.4	162.093
33	PTW-2	74.2	161.75
34	PTW-3	77.4	161.529
35	PTW-4	71.9	161.492
36	PTW-5	73.85	161.152
37	PTW-6	68.9	161.032
38	PTW-7	73.2	161.1301
39	PTW-8	78.2	161.343
40	PTW-9	61.9	161.6995
41	PTW-10	67.2	161.6032
42	PTW-11	68	161.6577

S.No.	Well #	Water Levels, ft
45	CBP-1	78.25
46	PT-AU	55.35
47	PT-AD	85.6
48	PT-BU	75.2
49	PT-BD	80.37
50	PT-CU	77.25
51	PT-CD	78.1
52	PT-DU	81.64
53	PT-DD	92.56
54	WW-2	96.26
55	RBLA-1	64.75
56	RBLA-2	83.54
57	RBLA-3	80.6
58	RBLA-4	N/A
59	RBLA-5	74.55
60	RBLB-1	74.4
61	RBLB-2	51.65
62	RBLB-3	71.71
63	RBLB-4	73.1
64	RBLB-5	73.55
65	RBLC-1	77.88
66	RBLC-2	70.65
67	RBLC-3	65.1
68	RBLC-4	60.8
69	RBLC-7	77.15
70	RBLD-1	56.15
71	RBLD-2	84.8
72	RBLD-3A	72.23
73	RBLD-5	91.1
74	RBLD-6	89.65

43	PTW-12	72.97	161.1325
44	PTW-13	73.95	160.3801



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Response to Items A and B Table 2

WELL #	Sept 08 Water Level Elevations (ft) Calculated in Sept 2008	Sept 08 Water Level Elevations (ft) Calculated on Sept 21,2012	Water Level Elevation (ft)***	2008 Surface Elevations (ft)	2010 Surface Elevations (ft)	Surface Elevation (ft) Differences	2008 CHAGS Height (in)	2012 CHAGS Height (in)	CHAGS Height Differences (in)
BMW-1	160.820	160.820	0.000	228.510	228.510	0.000	26.520	26.520	0.000
BMW-2	160.810	160.810	0.000	228.934	228.934	0.000	26.712	26.712	0.000
BMW-3	161.074	161.074	0.000	228.989	228.989	0.000	29.460	29.460	0.000
BMW-4	161.340	161.133	0.207	233.517	233.627	-0.110	32.796	29.000	3.796
BMW-5	161.470	161.457	0.013	236.071	236.107	-0.036	27.588	27.000	0.588
BMW-6	161.510	161.669	-0.159	234.475	234.735	-0.260	29.220	28.000	1.220
BMW-7*	166.663	161.902	4.761	236.782	232.569	4.213	34.572	28.000	6.572
BMW-8	162.153	161.813	0.340	229.294	228.913	0.381	23.508	24.000	-0.492
BMW-9**	160.821	161.824	-1.003	230.791	230.791	0.000	15.960	28.000	-12.040
BMW-10	162.200	162.298	-0.098	225.481	225.481	0.000	27.828	29.000	-1.172
BMW-11	162.143	161.766	0.377	215.233	215.233	0.000	26.520	22.000	4.520
BMW-12	161.828	162.004	-0.176	214.612	215.201	-0.589	29.952	25.000	4.952
BMW-13	162.008	161.863	0.145	223.530	223.530	0.000	26.736	25.000	1.736
BMW-14	161.762	161.762	0.000	232.502	232.502	0.000	24.120	24.120	0.000
BMW-15	161.499	161.425	0.074	237.692	237.692	0.000	25.884	25.000	0.884
BMW-16	161.411	161.411	0.000	230.590	230.590	0.000	25.092	25.092	0.000
BMW-17	161.345	161.083	0.262	225.220	224.983	0.237	24.300	24.000	0.300
BMW-18	160.977	160.910	0.067	222.943	222.943	0.000	26.808	26.000	0.808
BMW-19	160.780	160.835	-0.055	225.385	225.385	0.000	29.340	30.000	-0.660
BMW-20	160.764	160.553	0.211	226.656	226.836	-0.180	30.696	26.000	4.696
BMW-21	160.690	160.481	0.209	226.934	226.934	0.000	25.512	23.000	2.512
BMW-22	160.696	160.618	0.078	227.751	227.751	0.000	23.940	23.000	0.940
OMW-1	159.769								
OMW-2	159.583								
OMW-3	159.642								
OMW-4	159.222								
OMW-5	159.452								
OMW-6	159.078								

OMW-7	159.127								
OMW-8	158.938								
OMW-9	158.987								
PTW-1	162.093	161.895	0.198	224.029	224.128	-0.099	29.568	26.000	3.568
PTW-2	161.750	161.820	-0.070	233.616	233.770	-0.154	28.008	27.000	1.008
PTW-3	161.529	161.397	0.132	236.625	236.631	-0.006	27.648	26.000	1.648
PTW-4	161.492	161.298	0.194	231.103	231.531	-0.428	27.468	20.000	7.468
PTW-5	161.152	161.237	-0.085	232.720	232.837	-0.117	27.384	27.000	0.384
PTW-6	161.032	161.142	-0.110	227.514	227.708	-0.194	29.016	28.000	1.016
PTW-7	161.130	161.264	-0.134	232.297	232.297	0.000	24.394	26.000	-1.606
PTW-8	161.343	161.238	0.105	237.438	237.438	0.000	25.256	24.000	1.256
PTW-9	161.700	161.914	-0.215	221.731	221.731	0.000	22.422	25.000	-2.578
PTW-10	161.603	161.484	0.119	226.767	226.767	0.000	24.433	23.000	1.433
PTW-11	161.658	161.658	0.000	227.646	227.646	0.000	24.137	24.137	0.000
PTW-12	161.133	161.287	-0.155	232.174	232.174	0.000	23.142	25.000	-1.858
PTW-13	160.380	160.431	-0.051	232.297	232.297	0.000	24.394	25.000	-0.606
PTW-14 (CBP-1)	161.180	161.520	-0.340	237.687	237.687	0.000	20.916	25.000	-4.084
PT-AU	193.929								
PT-AD	159.831								
PT-BU	169.667								
PT-BD	162.168								
PT-CU	167.235								
PT-CD	163.754								
PT-DU	166.351								
PT-DD	150.706								
WW-2	143.170								
RBLA-1	158.702								
RBLA-2	158.983								
RBLA-3	159.000								
RBLA-4									
RBLA-5	158.893								
RBLB-1	161.361	161.361	0.000	233.824	233.824	0.000	23.248	23.248	0.000
RBLB-2	170.541								
RBLB-3	161.362	161.362	0.000	231.338	231.338	0.000	20.807	20.807	0.000

RBLB-4	161.738	161.738	0.000	233.057	233.057	0.000	21.382	21.382	0.000
RBLB-5	161.198	161.001	0.197	232.134	232.134	0.000	31.362	29.000	2.362
RBLC-1	169.078								
RBLC-2	163.924								
RBLC-3	162.186								
RBLC-4	163.785								
RBLC-7	169.094								
RBLD-1	165.597								
RBLD-2	148.253								
RBLD-3A	147.302								
RBLD-5	148.738								
RBLD-6	166.163								

* The 2010 survey corrected a significant 2008 survey error in the ground surface elevation of BMW-7. The 2010 surveyed elevation was verified on 9-19

** The casing height recorded for BMW-9 in 2008 is about a foot less than the height measured on 9-19-12. It is likely that the 2008 measurement was 21 inches instead of the 15.96 inches recorded.

*** Water level elevation differences for wells other than BMW-7 and BMW-9 averaged less than 1.5 inches.

Calculated Change		
CHAGS	due to Surface	
Height	Elevation and	
Differences	CHAGS Differences	
(ft)	(ft)	
0.000	0.000	
0.000	0.000	
0.000	0.000	
0.316	0.207	
0.049	0.013	
0.102	-0.159	
0.548	4.761	
-0.041	0.340	
-1.003	-1.003	
-0.098	-0.098	
0.377	0.377	
0.413	-0.176	
0.145	0.145	
0.000	0.000	
0.074	0.074	
0.000	0.000	
0.025	0.262	
0.067	0.067	
-0.055	-0.055	
0.391	0.211	
0.209	0.209	
0.078	0.078	

0.297	0.198
0.084	-0.070
0.137	0.132
0.622	0.194
0.032	-0.085
0.085	-0.110
-0.134	-0.134
0.105	0.105
-0.215	-0.215
0.119	0.119
0.000	0.000
-0.155	-0.155
-0.051	-0.051
-0.340	-0.340

0.000	0.000
0.000	0.000

0.000	0.000
0.197	0.197

-12.
5.96



Response to Requested Information

craig w. holmes to: Stacey Dwyer

Cc: William Honker, Philip Dellinger, Sam Coleman

09/28/2012 02:31 PM

From: "craig w. holmes" <pommelhouse@sbcglobal.net>
To: Stacey Dwyer/R6/USEPA/US@EPA
Cc: William Honker/R6/USEPA/US@EPA, Philip Dellinger/R6/USEPA/US@EPA, Sam Coleman/R6/USEPA/US@EPA

Stacey,

Attached are five documents providing responses to the information that Region 6 requested during our telephone conference call on September 25, 2012. We would like to have a telephone conference call with you on Monday after you have had time to review the response. We think a call will help everyone get a good grasp on the information. Have a good weekend.



craig w. holmes Overview.docx Responses.doc Response A and B Table 1.xls



Response to A and B Items Table 2.xlsx Response to Item D Table 1.xlsx

Response to Item D Table 1

WELL #	Water Level Elevations (ft)		Water Level Elevations (ft)		Water Level Elevation Differences (ft)***		2010 Surface Elevations (ft)	2008 Surface Elevations (ft)	Surface Elevation Differences (ft)		2012 CHAGS Height (in)	2010 CHAGS Height (in)	CHAGS Height Differences (in)	
	Calculated	on July 12, 2012	Calculated	on Sept 21, 2012										
BMW-1	158.440		158.440		0.000		228.510	228.510	0.000		26.52	26.52	0.00	
BMW-2	158.520		158.520		0.000		228.934	228.934	0.000		26.71	26.71	0.00	
BMW-3	158.804		158.804		0.000		228.989	228.989	0.000		29.46	29.46	0.00	
BMW-4	159.166		159.003		-0.162		233.627	233.517	0.110		29.00	32.26	-3.26	
BMW-6	159.318		159.259		-0.059		234.735	234.475	0.260		28.00	31.84	-3.84	
BMW-7*	164.246		159.582		-4.664		232.569	236.782	-4.213		28.00	33.41	-5.41	
BMW-8	160.330		159.583		-0.747		228.913	229.294	-0.381		24.00	28.39	-4.39	
BMW-9**	158.441		159.444		1.003		230.791	230.791	0.000		28.00	15.96	12.04	
BMW-10	159.860		159.958		0.098		225.481	225.481	0.000		29.00	27.83	1.17	
BMW-11	160.093		159.716		-0.377		215.233	215.233	0.000		22.00	26.52	-4.52	
BMW-12	159.540		160.024		0.484		215.201	214.612	0.589		25.00	26.25	-1.25	
BMW-13	159.708		159.563		-0.145		223.530	223.530	0.000		25.00	26.74	-1.74	
BMW-14	159.452		159.452		0.000		232.502	232.502	0.000		24.12	24.12	0.00	
BMW-15	159.219		159.145		-0.074		237.692	237.692	0.000		25.00	25.88	-0.88	
BMW-16	159.081		159.081		0.000		230.590	230.590	0.000		25.09	25.09	0.00	
BMW-17	159.520		159.043		-0.477		224.983	225.220	-0.237		24.00	26.88	-2.88	
BMW-18	158.697		158.630		-0.067		222.943	222.943	0.000		26.00	26.81	-0.81	
BMW-19	158.510		158.565		0.055		225.385	225.385	0.000		30.00	29.34	0.66	
BMW-20	158.663		158.503		-0.161		226.836	226.656	0.180		26.00	30.09	-4.09	
BMW-21	158.410		158.201		-0.209		226.934	226.934	0.000		23.00	25.51	-2.51	
BMW-22	158.416		158.338		-0.078		227.751	227.751	0.000		23.00	23.94	-0.94	
PTW-1	159.590		159.495		-0.096		224.128	224.029	0.099		26.00	28.33	-2.33	
PTW-2	159.420		159.520		0.100		233.770	233.616	0.154		27.00	27.64	-0.64	
PTW-3	159.406		159.097		-0.309		236.631	236.625	0.006		26.00	29.77	-3.77	
PTW-4	158.850		159.018		0.168		231.531	231.103	0.428		20.00	23.12	-3.12	
PTW-5	159.094		158.927		-0.167		232.837	232.720	0.117		27.00	30.41	-3.41	
PTW-6	159.007		158.892		-0.115		227.708	227.514	0.194		28.00	31.72	-3.72	

PTW-7	158.850	158.984	0.134	232.297	232.297	0.000	26.00	24.39	1.61
PTW-8	158.993	158.888	-0.105	237.438	237.438	0.000	24.00	25.26	-1.26
PTW-9	159.350	159.564	0.215	221.731	221.731	0.000	25.00	22.42	2.58
PTW-10	159.223	159.104	-0.119	226.767	226.767	0.000	23.00	24.43	-1.43
PTW-11	159.308	159.308	0.000	227.646	227.646	0.000	24.14	24.14	0.00
PTW-12	158.873	159.027	0.155	232.174	232.174	0.000	25.00	23.14	1.86
PTW-13	158.120	158.171	0.051	232.297	232.297	0.000	25.00	24.39	0.61
PTW-14 (CBP-1)	N/A(1)	159.190	N/A(1)	237.687	237.687	0.000	25.00	20.92	4.08
PT-BD	159.613	N/A(2)	N/A(2)	N/A(2)	N/A(2)	N/A(2)	N/A(2)	N/A(2)	N/A(2)
RBLB-1	159.081	159.081	0.000	233.824	233.824	0.000	23.25	23.25	0.00
RBLB-3	159.072	159.072	0.000	231.338	231.338	0.000	20.81	20.81	0.00
RBLB-4	159.418	159.418	0.000	233.057	233.057	0.000	21.38	21.38	0.00
RBLB-5	158.948	158.751	-0.197	232.134	232.134	0.000	29.00	31.36	-2.36

* The 2010 survey corrected a significant 2008 survey error in the ground surface elevation of BMW-7. The 2010 surveyed elevation was verified on 9-15

** The casing height recorded for BMW-9 in 2008 is about a foot less than the height measured on 9-19-12. It is likely that the 2008 measurement was 2 inches instead of the 15.96 inches recorded.

*** Water level elevation differences for wells other than BMW-7 and BMW-9 averaged less than 1.75 inches.

CHAGS Height Differences	Calculated Change due to Surface Elevation and CHAGS Differences
(ft)	(ft)
0.000	0.000
0.000	0.000
0.000	0.000
-0.272	-0.162
-0.320	-0.059
-0.450	-4.664
-0.366	-0.747
1.003	1.003
0.098	0.098
-0.377	-0.377
-0.104	0.484
-0.145	-0.145
0.000	0.000
-0.074	-0.074
0.000	0.000
-0.240	-0.477
-0.067	-0.067
0.055	0.055
-0.341	-0.161
-0.209	-0.209
-0.078	-0.078
-0.195	-0.096
-0.054	0.100
-0.315	-0.309
-0.260	0.168
-0.284	-0.167
-0.310	-0.115

0.134	0.134
-0.105	-0.105
0.215	0.215
-0.119	-0.119
0.000	0.000
0.155	0.155
0.051	0.051
0.340	0.340
N/A(2)	N/A(2)
0.000	0.000
0.000	0.000
0.000	0.000
-0.197	-0.197

h-12.
5.96